United States
Department
of Agriculture

Forest Service

Intermountain
Research Station

Research Paper
INT-445

June 1991

Small Mammals of a Beaver Pond Ecosystem and Adjacent Riparian Habitat in Idaho

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ACKNOWLEDGMENTS

We gratefully acknowledge the field or office assistance of John W. Kinney, Sherri A. Brown, Justine L. Wirch, Kevin Tom, and Patrick V. Turner. Lyle A. Lewis, Caryl Elzinga, Loren D. Anderson, and Gloria Romero provided unpublished information about the study area.

RESEARCH SUMMARY

We compared small mammal populations and community organization between a beaver pond ecosystem dominated by willows (*Salix* spp.) and an adjacent nonwillow riparian habitat on Summit Creek in east-central Idaho. Populations were assessed by removal trapping on 1.7-ha grids in late summer of 1988 and 1989. Small mammal relative density was 3.06 times higher and standing crop biomass was 2.71 times higher in the beaver pond habitat than in the adjacent nonponded habitat. There were no pronounced differences between the two habitats in small mammal species richness or species diversity. Montane voles (*Microtus montanus*) and shrews (*Sorex* spp.) were most abundant in the beaver pond habitat, while the deer mouse (*Peromyscus maniculatus*) was the most commonly trapped small mammal in the nonponded riparian area. Among four foraging guilds represented on the study site, herbivores and insectivores were numerically dominant in the beaver pond habitat. The dense and structurally more complex vegetation of the beaver pond ecosystem apparently provided the food and cover resources needed to support larger populations of small mammals.

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INTRODUCTION

Beaver (*Castor canadensis*) are important regulators of aquatic and terrestrial ecosystems, with pervasive effects far beyond their food and space requirements (Naiman and others 1988). Dam building creates habitats that are important for some forms of wildlife, particularly fish, waterfowl, and browsing mammals (Jenkins and Busher 1979). But there are few quantitative assessments of the importance of beaver pond habitats for nongame wildlife. This study compared small mammal populations and community organization between a willow-dominated beaver pond ecosystem and an adjacent nonwillow riparian habitat on Summit Creek in east-central Idaho.

Beavers built both a primary dam and several secondary dams in a previously unoccupied section of Summit Creek in the summer and fall of 1979 (Lewis 1989). During our study, about 0.3 ha of surface water was impounded by the dams. Both the beaver pond complex and the adjacent site were protected from livestock grazing for the previous 14 years by a large (122-ha) fenced exclosure. The exclosure, constructed in 1975, is on public lands administered by the Bureau of Land Management, U.S. Department of the Interior.

STUDY AREA

The study site was 41 km north of Mackay in eastern Custer County, ID. Elevation is approximately 1,975 m. Summit Creek, a tributary of the Little Lost River, originates from springs and flows through a broad, basinlike valley bounded on the east by the Lemhi Range and on the west by the Lost River Range. Regional climate is semiarid. Average annual precipitation at Mackay (elevation 1,797 m) is 247 mm, with peaks in May and June. The growing season is short, averaging less than 100 days at Mackay (USDC NOAA 1982). Microrelief in many parts of the study site is hummocky, with soils high in total salts (USDA SCS 1987). Except for the beaver dam pond complex, the riparian zone is seldom more than 50 to 100 m wide.

Four major vegetation community types were defined on the study site. These were: willow (*Salix* spp.)/mesic herbaceous, sagebrush (*Artemisia* spp.)/upland, mat muhly (*Muhlenbergia richardsonis*)/hummock, and mesic herbaceous. The willow/mesic herbaceous community type was found only in the immediate vicinity of the beaver pond. Sagebrush/upland communities occupied the gentle slopes and terraces that bordered both the beaver pond complex and the adjacent areas. The other two types—mat muhly/hummock, and mesic herbaceous—were elements of the riparian zone and were found on both the beaver pond site and adjacent sites.

Upland vegetation was shrub-steppe (West 1983). The most common shrubs were low sagebrush (*A. arbuscula*), threetip sagebrush (*A. tripartita*), and green rabbitbrush (*Chrysothamnus viscidiflorus*). The understory included Sandberg's bluegrass (*Poa sandbergii*), bluebunch wheatgrass (*Agropyron spicatum*), and long-leaf phlox (*Phlox longifolia*). Geyer willow (*S. geyeriana*), bilberry willow (*S. myrtillifolia*), Bebb willow (*S. bebbiana*), and water birch (*Betula occidentalis*) formed the tall-shrub overstory of the willow/mesic herbaceous community. The understory included a wide variety of graminoids and forbs. The stream was closely bordered by clumped mesic herbaceous communities dominated by beaked sedge (*Carex rostrata*), water sedge (*C. aquatilis*), Baltic rush (*Juncus balticus*), and Kentucky bluegrass (*Poa pratensis*). Hummocky areas, dominated by mat muhly and thick-spiked wheatgrass (*Agropyron dasystachyum*), were generally located in an intermediate position between the streamside communities and the sagebrush uplands.

METHODS

Two 1.7-ha trapping grids, one in the upper (westernmost) section of the fenced exclosure and the other in the beaver pond area, were established to sample small mammal populations. Grid locations were selected to best represent both the beaver pond complex and the adjacent nonponded riparian habitat. Each grid measured 225 by 75 m and

consisted of 40 trapping stations systematically spaced in 10 rows and four columns. The rectangular grids were positioned lengthwise along Summit Creek and straddled the stream channel. The trapping grid sampling the beaver pond area was centered on the main pond.

Grid dimensions were surveyed and trapping stations marked with numbered stakes at 25-m intervals. Two Museum Special mouse traps and one Victor rat trap were located within a 2-m radius of each measured grid point. Traps were baited with a mixture of peanut butter and rolled oats and examined for 5 consecutive days from August 3-7, 1988, and from August 17-21, 1989. Traps on both grids were examined once each day to minimize the influence of weather on comparative catches. Species, sex, weight, and station number were recorded for each captured animal. The reciprocal of Simpson's index ($D = 1/\Sigma p_i^2$, where p_i is the proportion of the sample belonging to the ith species) was used to calculate species diversity (Hill 1973).

Plant nomenclature is from Hitchcock and Cronquist (1973). Scientific and common names of mammals follow Jones and others (1986).

RESULTS AND DISCUSSION

A total of 2,400 trap nights yielded 203 individual small mammals in the two seasons of study at Summit Creek. Eight species of rodents and shrews were caught; these included montane voles (*Microtus montanus*), 46.3 percent; shrews (*Sorex* spp.), 32.0 percent; deer mice (*Peromycus maniculatus*), 15.8 percent; water shrews (*S. palustris*), 2.5 percent; western jumping mice (*Zapus princeps*), 1.5 percent; long-tailed voles (*M. longicaudus*), 1.0 percent; Great Basin pocket mice (*Perognathus parvus*), 0.5 percent; and northern pocket gophers (*Thomomys talpoides*), 0.5 percent. Montane voles, deer mice, and shrews were caught on both the beaver pond area and the adjacent nonwillow habitat. Other species were caught irregularly and in smaller numbers.

The total number of small mammals trapped was much larger (153) in the beaver pond habitat compared to the nonponded habitat (50). Relative density in the beaver pond habitat was about three times that of the adjacent area in each of the 2 years of study (table 1). Similarly, small mammal standing crop biomass was substantially higher in the beaver pond ecosystem. There was no pronounced difference in the two habitats in either species richness or our estimates of species diversity. Six small mammal species were recorded in each habitat (table 1).

Montane vole populations differed dramatically between the two habitats (table 1). Almost 80 percent of the montane voles trapped were caught in the beaver pond complex. Of these, most were trapped in streamside habitats, with the frequency of capture highest in thick stands of grasses, sedges, and rushes that formed the ground layer of willow/mesic herbaceous communities. None were caught in sagebrush/upland communities. In Idaho, montane voles occur most commonly in moist, weedy, or brushy areas near water (Larrison and Johnson 1981). The importance of vegetative cover to the montane vole has been well documented (for example, Brown 1967a; O'Farrell and Clark 1986).

Shrews other than the water shrew were trapped almost exclusively in the willow/mesic herbaceous communities that encircled the beaver pond. Only a single specimen was caught in the nonwillow study area. Shrews, along with montane voles, were the most commonly trapped small mammals in the beaver pond ecosystem (table 1). They were frequently caught in runways of the montane vole. In Idaho, most shrews are found in moist, grassy habitats (Larrison and Johnson 1981), but they occur in a variety of other habitats including forests and shrublands (Brown 1967b). The association of vagrant shrew (*Sorex vagrans*) populations with densely vegetated and marshy habitats has been reported in California (Ingles 1961), Colorado (Spencer and Pettus 1966), Oregon (Hooven and others 1975), Montana (Clothier 1955), and Washington (Newman 1976).

Captures of water shrews were infrequent and consisted of only two or three animals in each trapping period. They were trapped in both the beaver pond and adjacent nonponded habitats. All were caught near swift-flowing sections of the stream in willow or mesic herbaceous communities. In Manitoba, a close correlation existed between the local distribution water shrews and beaver pond habitats (Wrigley and others 1979).

Deer mice were trapped in both the beaver pond habitat and the nonwillow area, and in each of the plant community types described for the Summit Creek study site. Overall, relative density in the nonponded area was three times that found in the beaver pond ecosystem (table 1). Most deer mice were trapped in sagebrush/upland communities that bordered the riparian zone. They were caught infrequently in the thickly vegetated, willow-dominated beaver pond habitat and in other streamside habitats. The deer mouse is found in diverse habitats including swamps, waterways, forests, grasslands, and deserts, and among rocks and cliffs (Larrison and Johnson 1981). Higher relative densities in the drier and less densely vegetated sagebrush community type at Summit Creek suggests an affinity by the deer mouse for low-shrub habitats with a sparse herbaceous understory.

Other species of small mammals were either trapped or observed on the Summit Creek study site. The Great Basin pocket mouse, a species normally associated with arid and semiarid habitats

Table 1—Relative density, diversity, and other attributes of small mammal populations in a willow-dominated beaver pond ecosystem and adjacent nonwillow riparian habitat, Summit Creek, ID, 1988-1989

Species and habitat	Foraging guild[1]	Relative density: Number/100 trap nights 1988	Relative density: Number/100 trap nights 1989	Relative density: Number trapped/ha 1988	Relative density: Number trapped/ha 1989
Sorex spp.[2]	INS				
Beaver pond		7.0	3.7	24.9	13.0
Adjacent		.2	0	.6	0
Sorex palustris	INS				
Beaver pond		.2	.2	.6	.6
Adjacent		.2	.3	.6	1.2
Thomomys talpoides	HER				
Beaver pond		0	0	0	0
Adjacent		.2	0	.6	0
Perognathus parvus	GRA				
Beaver pond		0	0	0	0
Adjacent		.2	0	.6	0
Peromyscus maniculatus	OMN				
Beaver pond		1.3	0	4.7	0
Adjacent		2.7	1.3	9.5	4.7
Microtus longicaudus	HER				
Beaver pond		.2	.2	.6	.6
Adjacent		0	0	0	0
Microtus montanus	HER				
Beaver pond		5.7	6.7	20.1	23.7
Adjacent		1.5	1.8	5.3	6.5
Zapus princeps	OMN				
Beaver pond		.3	.2	1.2	.6
Adjacent		0	0	0	0
Total trapped (*n*/ha)					
Beaver pond				52.1	38.5
Adjacent				17.2	12.4
Standing crop biomass (g/ha)					
Beaver pond				819	773
Adjacent				304	283
Species richness (*n*)					
Beaver pond				6	5
Adjacent				6	3
Species diversity[3] ($1/\Sigma p_i^2$)					
Beaver pond				2.59	2.02
Adjacent				2.47	2.33

[1]After Martin and others (1951). INS = insectivore, HER = herbivore, GRA = granivore, OMN = omnivore.
[2]Identification not confirmed; most appeared to be vagrant shrews (*Sorex vagrans*).
[3]After Hill (1973). Here p_i is the proportional abundance of the *n* species in a sample.

(Verts and Kirkland 1988), was caught at a single location in the sagebrush/upland community type where giant wildrye (*Elymus cinereus*) was codominant with scattered sagebrush and rabbitbrush plants. Only a few individuals of the long-tailed vole and western jumping mouse were trapped, and those only in the beaver pond habitat. They were caught in dense stands of grasses and sedges beneath a willow overstory. Mounds of the northern pocket gopher were evident throughout the area, but only one gopher was caught. Mink (*Mustela vison*) and muskrats (*Ondatra zibethicus*) were occasionally observed in or near the beaver pond.

Four foraging guilds were represented among the small mammals trapped at Summit Creek (table 1). Together, herbivores and insectivores accounted for almost 82 percent of the total small mammal community. The large majority of these—montane voles, shrews, and long-tailed voles—were found in the beaver pond ecosystem. Most of the omnivores

and granivores—deer mice, western jumping mice, and Great Basin pocket mice—were caught in the nonponded habitat. Each of the herbivorous and insectivorous species trapped in the beaver pond habitat at Summit Creek has been shown to prefer or characterize areas with substantial herbaceous ground cover (Clark 1973; Hooven and others 1975; Feldhamer 1979; Smolen and Keller 1987).

In sum, we found clearly marked differences in small mammal populations and community composition between a willow-dominated beaver pond ecosystem and an adjacent nonponded riparian habitat. Relative small mammal density and standing crop biomass were two to three times higher in the moist, densely vegetated beaver pond habitat when compared to the drier, more sparsely vegetated adjacent riparian habitat. Among four foraging guilds represented on the Summit Creek site, herbivores and insectivores were numerically dominant in the beaver pond complex. We suggest that the dense and structurally more complex vegetation of the beaver pond ecosystem produced the food and cover resources needed to support higher relative populations of small mammals.

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KEYWORDS: density, diversity, standing crop biomass, rodents, shrews, populations, *Salix* spp.

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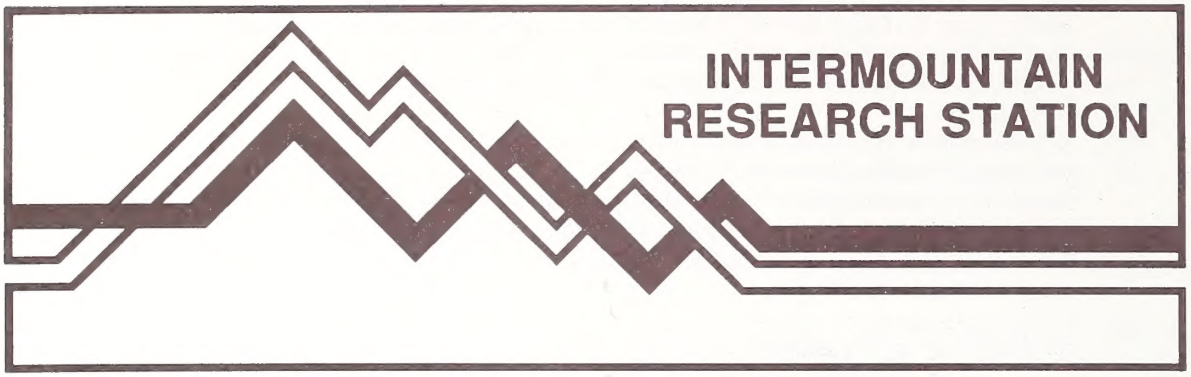

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